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BEFORE THE LEAP TO THE STARS

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Before the Leap to the Stars

A. Golikov and I. Kas'yan

A large, gray building. Here, future stellar pilots are being prepared for space trips. In a spacious laboratory, where equipment and trainers gleam with glass and nickel, we talk with a research doctor and ask him to tell us of the features in the flight training of A. Nikolayev and P. Popovich.

After the flights of Yu. Gagarin and G. Titov, various investigations of the influence of weightlessness on the human organism were conducted, and means were sought for reducing its harmful action. Why do I begin the story just with this? Now the majority of specialists consider that the prolonged state of weightlessness, which man will experience in future space trips, is an unusual, complex and powerful irritant. It influences all the human physiological systems.

The most radical means of preventing the harmful effect of weightlessness is the creation of artificial gravity in the space ship. Tsiolkovskiy already proposed this. If it seems that people cannot live without gravity, the rocket must be subjected to rotatory motion, and centrifugal force will create artificial gravity of the desired amount. There is a convient apparatus before us for experimental animals.

.....The doctor brings us to a small centrafuge. Its arm is not larger than a meter, and there is a spacious glass flask at its end. They explain to us that this centrafuge is installed in a special aircraft. White rabbits and mice

are placed in the flask. When the flyer creates a state of brief weightlessness, by piloting, the centrafuge is rotated and forms gravitation.

--How did the experimental animals behave in this situation?

--The purpose of this investigation consisted in determining the minimum amount of artificial gravity, necessary for coordination of movements, and preservation of the correct body position. The animals were rotated in confusion in the weightlessness. Sometimes the rotation was stopped, and the animals lived just as in the air, by moving their paws widely apart. In creating artificial gravity the character of the movements was changed. When its value reached 0.3 units of the earth's gravity, the behavior of the animals during the experiment became the same as under laboratory conditions. This, of course, does not mean that such a force will be sufficient for a man to execute the normal movements in the state of weightlessness. In attempting to raise the stability of the vestibular apperatus of A. Nikolayev and P. Popovich, they were trained in new devices. Here is one of them -- "rotation on an unsteady support".

Before us is a small platform, resembling a round table. In the center is a chair, known by everyone who went to flying school or was trained to be a parachutist.

The astronaut is seated on the chair, closes his eyes, and the platform is rotated together with him. When it is brought to a stop, the doctor pulls a lever, and the platform is placed on one hinged support, located in its center. The astronaut must be able to quickly assume the correct position, and then the platform is put into a horizontal position.

--Can we try it?

--Please...In turn...

"Rotation on an unsteady support" seems to be an uncomplicated exercise. You sit confidently in the chair, place your arms on the elbow-rests and close your eyes.

--Your trainer is just like Nikolayev's, -- the doctor smiles.

You know thoroughly that you are rotated to the right side. But right after the first revolutions you will feel that you are spinning to the left. This is known as the illusion of anti-rotation! The chair stops. You open your eyes, straighten yourself up, but incline to the left involuntarily.... The support is actually unsteady. The chair and the platform are also inclined. They only list to the other side. You make a correction--"fall" backwards, then forwards, again to the left...

The doctor follows the hand of a stop-watch and when this damned chair returns to normal, he notes the time.

--It is not bad for the beginning. But it is three times slower than Nikolayev. Catch up with him,--jokes the doctor.

By means of this apparatus research has already been conducted. In weightless conditions the action of a galvanic current on the vestibular apparatus was studied.

These experiments, in particular, indicated that in the state of weightlessness the illusion of anti-rotation becomes briefer. The exitability of the vestibular apparatus towards angular accelerations is reduced. It is established also, that weightlessness does not lead to the functional turning-off of the otolitic apparatus, and is only an extreme irritant for it. All this provided the doctor with very valuable material and permitted the training of the astronauts to be more real.

...They show us a photograph : a room, the walls of which are covered with a luminous material. There are thick mats on the ceiling. And along the floor, in the middle of which is an electric plafond, walks Adrian Nikolayev in a space suit.

--You are holding the photograph upside down, -- smiles the doctor.

--Is that right? This means, in your opinion, Nikolayev is walking on the ceiling?

--That's it. This is how he was trained in a weightless period in a special aircraft. Weightlessness occurs in piloting, and the astronauts at this time perform various exercises. As we know, in the vestibular apparatus, besides the otoliths, there are three semicircular canals: the horizontal, saggital and frontal. For training the horizontal canal Nikolayev and Popovich rotated to the right and to the left, for the saggital they did a cart-wheel and for the frontal, a forward and backward somersault. They also did acrobatics -- spinning, rolling; as you see, Nikolayev walked along the ceiling.

All the exercises were done with the eyes open and closed. The astronauts' coordination of movements was undisturbed and their state-of-being was good. Thus, Nikolayev's pulse on the ground before and after the "flight" fluctuated from 72 to 88 per minute.

The doctor reaches for a journal and reads an inscription made there: "In the process of the entire flight Nikolayev's state-of-being was good. Coordination of movements was unchanged... The flight provided good training for overcoming the effect of weightlessness..."

Popovich tells of one of the first flights in a state of weightlessness in this manner: "...My right hand holding a pencil, I began to hit the sockets of the coordinograph. I did not experience any difficulties in this. One thing became apparant: the movement must be made smoothly. In an abrupt movement the body shifts from one side to the other..."

...Other investigations were also conducted during flights in zero-gravity: For example, the assortment of space food was expanded and changed greatly. The research doctor opens a large refrigerator and shows us something:

--Here are objects of the investigation tested on the aircraft.

On a dish are small rolls, wrapped in cellophane, the size of apricots. They can be taken in the mouth as a whole.

But there is still one everyday problem of prolonged space flight. The stellar

pilots tried to shave, wash and brush their teeth. And here certain complexities were cleared up: in rinsing the mouth and spitting out the water ~ a special vessel is needed to expell the water from the cabin.

--I myself tried to shave,--says the doctor. -- After three states of zero-gravity I lathered my beard, and on the third time I shaved with a safety razor. Generally, it was good, but practice is needed. It is better to shave with a mechanical razor...

Special physical exercises were selected for Nikolayev and Popovich which they would have to perform in flight. In a prolonged space trip physical conditioning is extremely necessary, otherwise muscular atrophy will result. The exercises were selected in such a manner as to develope every group o muscles and in this the needed load was obtained.

The entire flight from start to finish (launching to landing) was repeated in a model of the cabin of the "Vostok".

-. Is the cabin exactly like the cabin in which German Titov was trained?

-- Not entirely. Various improvements have been made. For example, a manual air temperature regulator is installed in the ship. Now the astronaut himself controls the given temperature during the flight. This is more convenient, although earlier, heat conditions were normal on our ships. And remember the heat endured in flight by the American astronaut! The means of communication with the earth were also improved and expanded.

In the repition of the flight the physiological background of the astronaut's organism was taken down; respiration, pulse, electroencephalogram etc. This data was compared later with the data which was fixed by A. Nikolayev and P. Popovich in orbit. Observations of the neuro-psychic spheres of the steller-pilots were conducted. After the "flight", A. Nikolayev's conversations were studied on magnetic tape-recorder film, ~ his reports, and the inscription he made in the log-book were examined. The research doctor shows us a space suit exactly like the one that

A. Nikolayev and P. Popovich flew in.

--We also tested a new selection of food products. Lemon was added, slices weighing about 50 grams, wrapped in cellophane. Water was placed here in this polyethylene reservoir. It was preliminarily bottled.

--How did the astronauts accomplish the final "flight" on the ground?

--In the course of the entire experiment their general state-of-being was good. Their appetite did not suffer. They precisley performed the daily routine, excellently carried out the mission, and appeared to have a clearly expressed capability for concentration of attention. And this attested to their complete efficiency. Both astronauts were throughly investigated also after the "flight". Their general state was good. Changes in the internal organs and neuro-psychic sphere were not discovered.

The conclusion of the commission was unanimous: "the celestial brothers" are completely prepared for an unparalled space voyage.

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